

单元测验查看

第六章 树测验

1

给出一棵树的逻辑结构 $T=(N,R)$,其中: $N=\{A,B,C,D,E,F,G,H,I,J,K\}$

$R=\{r\}$

$r=\{(A,B),(B,E),(B,F),(F,G),(F,H),(A,C),(C,I),(C,J),(J,K),(A,D)\}$

Given a logical structure of a tree, $T=(N, R)$, and $N=\{A, B, C, D, E, F, G, H, I, J, K\}$, $R=\{r\}$, $r=\{(A,B), (B,E), (B,F), (F,G), (F,H), (A,C), (C,I), (C,J), (J,K), (A,D)\}$

试回答下列问题:

Please answer these questions:

- (1) 哪个是根结点? which is the root node?
- (2) 哪些是F的孩子? which are the child nodes of Node F?
- (3) 结点K的层次是多少? (注: 根的层数为0, 独根树深度为0, 高度为1, 其他题目同样如此; 同一个选项的

答案如果有多个字母, 按照字典序排列, 且不要以空格分隔) (P.S. the level of the root node is 0, the depth of a tree, which only has a root node, is 0, and its height is 1. Other problems have the same regulations. If there are several alphabets in one question, order them by lexicographical order, and do not add spaces.)

(填空2 分)

文字精确: A GH 3

2 给出一棵树的逻辑结构 $T=(N,R)$,其中:

$N=\{A,B,C,D,E,F,G,H,I,J,K\}$

$R=\{r\}$

$r=\{(A,B),(B,E),(B,F),(F,G),(F,H),(A,C),(C,I),(C,J),(J,K),(A,D)\}$

试回答下列问题:

Given a logical structure of a tree, $T=(N, R)$, and $N=\{A, B, C, D, E, F, G, H, I, J, K\}$, $R=\{r\}$, $r=\{(A,B), (B,E), (B,F), (F,G), (F,H), (A,C), (C,I), (C,J), (J,K), (A,D)\}$ Please answer these questions:

- (1) 哪个是F的父结点? which is the parent node of Node F?
 - (2) 哪些是B的子孙? which are the offspring of Node B?
 - (3) 以结点C为根的子树的深度是多少? what is the depth of the sub-tree whose root node is Node C?
- (注: 根的层数为0, 独根树深度为0, 高度为1, 其他题目同样如此; 各个选项之间的答案用空格分隔就好; 同一个选项的答案如果有多个字母, 按照字典序排列, 且不要以空格分隔)
- (P.S. the level of the root node is 0, the depth of a tree, which only has a root node, is 0, and its height is 1. Other problems have the same regulations. If there are several alphabets in one question, order them by lexicographical order, and do not add spaces.)

(填空2 分)

文字精确: B EFGH 2

3 给出一棵树的逻辑结构 $T=(N,R)$,其中:

$N=\{A,B,C,D,E,F,G,H,I,J,K\}$

$R=\{r\}$

$r=\{(A,B),(B,E),(B,F),(F,G),(F,H),(A,C),(C,I),(C,J),(J,K),(A,D)\}$

试回答下列问题:

Given a logical structure of a tree, $T=(N, R)$, and $N=\{A, B, C, D, E, F, G, H, I, J, K\}$, $R=\{r\}$, $r=\{(A,B), (B,E), (B,F), (F,G), (F,H), (A,C), (C,I), (C,J), (J,K), (A,D)\}$ Please answer these questions:

- (1) 哪些是叶结点? which are the leaf nodes?
- (2) 哪些是F的祖先? which is the parent node of Node F?
- (3) 树的深度是多少? what is the depth of the tree?



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（注：根的层数为0，独根树深度为0，高度为1，其他题目同样如此；同一个小题的答案如果有多个字母，按照字典序排列，且不要以空格分隔，不同小题用一个空格隔开）

（填空2 分）

文字精确：DEGHIK AB 3

4 一个深度为h的满k叉树，最多有多少个叶结点？（独根树深度为0）(单选)

There is a full k-ary tree, whose depth is h. How many leaf nodes can it have at most? (The depth of a tree, which only has a root node, is 0.) (There is only one correct answer)

（单选2 分）

- ☐ A. k^h (正确答案)
- ☐ B. k^{h-1} (错误答案)
- ☐ C. $\frac{k^{h+1} - 1}{k - 1}$ (错误答案)
- ☐ D. $\frac{k^h - 1}{k - 1}$ (错误答案)

5 一个深度为h的满k叉树，最多有多少个结点？（独根树深度为0）

There is a full k-ary tree, whose depth is h. How many nodes can it have at most? (The depth of a tree, which only has a root node, is 0.)

（单选2 分）

- ☐ A. $\frac{k^{h+1} - 1}{k - 1}$ (正确答案)
- ☐ B. k^{h-1} (错误答案)
- ☐ C. k^h (错误答案)
- ☐ D. $\frac{k^h - 1}{k - 1}$ (错误答案)

6 若一个具有N个顶点，K条边的无向图是一个森林（ $N > K$ 且 $2K \geq N$ ），则该森林有多少棵树？

There is an undirected graph. It has N nodes and K edges. ($N > K$ and $2K \geq N$). If it is a forest, then how many trees will it has?

（填空2 分）

文字精确：N-K

解析：在一棵树中，结点比边多一个 The number of nodes is one more than the number of edges in a tree.

7 2-3树是一种特殊的树，它满足两个条件：

- （1）每个内部结点有两个或三个子结点；
- （2）所有的叶结点到根的路径长度相同；

如果一棵2-3树有9个叶结点，那么它可能有_____个非叶结点。（多项）

2-3 tree is a special kind of tree, it satisfy:

- （1）Every internal node has 2 or 3 child nodes.
- （2）All the leaf nodes have the same length of the path to the root node. If a 2-3 tree has 9 leaf nodes, then it may have _____ non-leaf nodes. (There are more than one correct answers)

（多选3 分）

- ☐ A. 4(正确答案)
- ☐ B. 7(正确答案)

解析：倒数第二层若是3个结点，深度为2，加上根结点，一共4个非叶子结点。
If the second level from the bottom has 3 nodes, the depth of tree will be 2, and the tree will has 4 non-leaf nodes, including the root node.

解析： 倒数第二层若是4个结点，深度为3，倒数第三层（第二层）有2个结点，一共4+2+1=7个非叶子结点。
If the second level from the bottom has 4 nodes, the depth of tree will be 3, the third level from the bottom will has 2 nodes, and the tree will has 4+2+1=7 non-leaf nodes

- ☐ C. 5(错误答案)
- ☐ D. 6(错误答案)

8 设F是由T1,T2,T3三棵树组成的森林，其中T1,T2,T3的结点数分别为n1,n2和n3，与F对应的二叉树为B，则二叉树B的右子树中有_____个结点(单选)

Assume that F is a forest, made up of tree T1, T2, T3, and the node numbers of T1, T2, T3 are n1, n2, n3. Let B be the corresponding binary tree of F, then B's right sub-tree will has _____ nodes. (There is only one correct answer)

(单选2 分)

- ☒ A. n2+n3(正确答案)
- ☐ B. n2(错误答案)
- ☐ C. n3(错误答案)
- ☐ D. n1+n3(错误答案)

解析： B的根是T1的根，右子树是从森林F'={T2, T3}转换而成的二叉树。换句话说，B右子树的结点数=T2结点数+T3结点数=n2+n3
B's root node is T1's root node, and B's right sub-tree is a binary tree, corresponding to the forest F'={T2, T3}. So, the number of nodes of B's right sub-tree equals to the sum of nodes of T2 and T3, namely, n2+n3.

9 设F是由T1,T2,T3三棵树组成的森林，其中T1,T2,T3的结点数分别为n1,n2和n3，与F对应的二叉树为B，则二叉树B的左子树中有_____个结点(单选)

Assume that F is a forest, made up of tree T1, T2, T3, and the node numbers of T1, T2, T3 are n1, n2, n3. Let B be the corresponding binary tree of F, then B's left sub-tree will has _____ nodes. (There is only one correct answer)

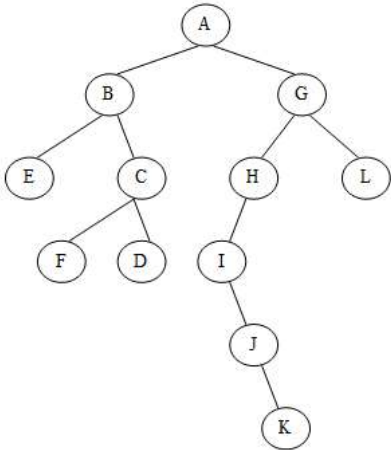
(单选2 分)

- ☒ A. n1-1(正确答案)
- ☐ B. n2-1(错误答案)
- ☐ C. n3-1(错误答案)
- ☐ D. (错误答案)
n2

解析： 解释： B的根是T1的根，左子树是从T1根结点的子树组成的森林转换成的二叉树。换句话说，B左子树的结点数=T1后代结点数=n1-1
B's root node is T1's root node, and B's left sub-tree is a binary tree, corresponding to the forest F'={T1}. So, the number of nodes of B's left sub-tree equals to the number of offspring nodes of

10 将下图的二叉树转换为对应的森林，按照先根次序列出其结点。（答案的字母之间没有空格）

Transform this binary tree into the corresponding forest, and write down the pre-order node sequence. (Do not add spaces in your answer.)

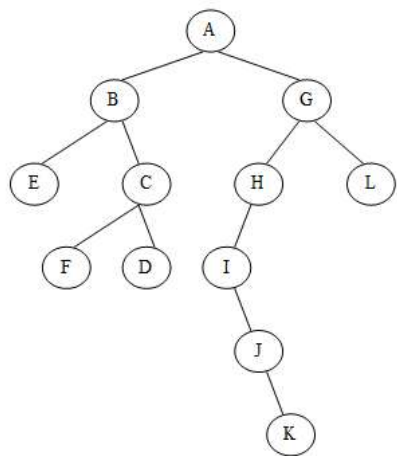


(填空2 分)

文字精确: ABECFDGHIJKL

11 将下图的二叉树转换为对应的森林，按照后根次序列出其结点。（答案的字母之间没有空格）

Transform this binary tree into the corresponding forest, and write down the post-order node sequence. (Do not add spaces in your answer.)



（填空2 分）

文字精确: EBFCDAIJKHGL

12 将一棵树T转换为左子/右兄链表表示的二叉树B，则T的后根次序遍历序列是B的相应_____序列。（单选）

Transform a tree T into a binary tree B, which is represented by Left-Child/Right-Sibling implementation. Then the post-order traversal sequence of T is the same as the _____ sequence of B. (There is only one correct answer)

（单选2 分）

- ☐ A. 中序遍历(正确答案)
- ☐ B. 前序遍历(错误答案)
- ☐ C. 后序遍历(错误答案)
- ☐ D. 层次遍历(错误答案)

13 一棵完全三叉树，下标为121的结点在第几层？

（注：下标号从0开始，根的层数为0）

In a complete 3-ary tree, what level is the node, whose subscript is 121, stand on? (P.S. the subscript starts form 0, and the level of root node is 0)

（填空2 分）

数值精确: 5

解析: 解释: 第h层的下标是从 $(3^h-1)/2$ 到 $(3^{h+1}-1)/2-1$ ，第5层的下标是从121到363。the subscript of the h level start from $(3^h-1)/2$ to $(3^{h+1}-1)/2-1$, so that the subscript of the fifth level is 121 to 363

14 一棵完全三叉树，下标为120的结点在第几层？

（注：下标号从0开始，根的层数为0）

In a complete 3-ary tree, what level is the node, whose subscript is 120, stand on? (P.S. the subscript starts form 0, and the level of root node is 0)

（填空2 分）

数值精确: 4

解析: 解释: 第h层的下标是从 $(3^h-1)/2$ 到 $(3^{h+1}-1)/2-1$ ，第5层的下标是从121到363。the subscript of the h level start from $(3^h-1)/2$ to $(3^{h+1}-1)/2-1$, so that the subscript of the fifth level is 121 to 363

15 根据树的双标记层次遍历序列，求其带度数的后根遍历序列

Given the double-tagging level-order traversal sequence of a tree, please write down the post-order traversal sequence with degree.

比如：已知一棵树的双标记层次遍历序列如下：

For example, assume that a tree's double-tagging level-order traversal sequence is shown as followed:

A : ltag: 0 , rtag 1
B : ltag: 0 , rtag 0
C : ltag: 0 , rtag 1
D : ltag: 1 , rtag 0
G : ltag: 0 , rtag 1
E : ltag: 0 , rtag 1
H : ltag: 1 , rtag 1
F : ltag: 1 , rtag 0
I : ltag: 1 , rtag 1

则其带度数的后根遍历序列为：

Then, its post-order traversal sequence with degree is:

D0 H0 G1 B2 F0 I0 E2 C1 A2

（注：各个节点按照“节点名度数”的方式给出，节点之间用空格分隔）

现给出树的双标记层次遍历序列如下，则其带度数的后根遍历序列为？

(P.S. The form of each node should be "NameDegree", and all the nodes are separated by only one space.)

Now, given a double-tagging level-order traversal sequence of a tree, shown as followed, please write down its post-order traversal sequence with degree.

A : ltag: 0 , rtag 1
B : ltag: 0 , rtag 0
E : ltag: 0 , rtag 1
C : ltag: 0 , rtag 0
D : ltag: 1 , rtag 0
G : ltag: 1 , rtag 1
F : ltag: 1 , rtag 0
I : ltag: 1 , rtag 1
H : ltag: 1 , rtag 1

（填空2 分）

文字精确：H0 C1 D0 G0 B3 F0 I0 E2 A2

16 根据树的双标记层次遍历序列，求其带度数的后根遍历序列

Given the double-tagging level-order traversal sequence of a tree, please write down the post-order traversal sequence with degree.

比如：已知一棵树的双标记层次遍历序列如下：

For example, assume that a tree's double-tagging level-order traversal sequence is shown as followed:

A : ltag: 0 , rtag 1
B : ltag: 0 , rtag 0
C : ltag: 0 , rtag 1
D : ltag: 1 , rtag 0
G : ltag: 0 , rtag 1
E : ltag: 0 , rtag 1
H : ltag: 1 , rtag 1
F : ltag: 1 , rtag 0
I : ltag: 1 , rtag 1

则其带度数的后根遍历序列为：

Then, its post-order traversal sequence with degree is:

D0 H0 G1 B2 F0 I0 E2 C1 A2

（注：各个节点按照“节点名度数”的方式给出，节点之间用空格分隔）

现给出树的双标记层次遍历序列如下，则其带度数的后根遍历序列为？

(P.S. The form of each node should be "NameDegree", and all the nodes are separated by only one space.)

Now, given a double-tagging level-order traversal sequence of a tree, shown as followed, please write down its post-order traversal sequence with degree.

A : ltag: 0 , rtag 1
B : ltag: 0 , rtag 0
C : ltag: 0 , rtag 0
E : ltag: 1 , rtag 0
F : ltag: 0 , rtag 1
G : ltag: 1 , rtag 1
D : ltag: 0 , rtag 1
I : ltag: 1 , rtag 1
H : ltag: 1 , rtag 1

（填空2 分）

文字精确：G0 B1 H0 D1 C1 E0 I0 F1 A4

17 根据树的双标记层次遍历序列，求其带度数的后根遍历序列

Given the double-tagging level-order traversal sequence of a tree, please write down the post-order traversal sequence with degree.

比如：已知一棵树的双标记层次遍历序列如下：
For example, assume that a tree's double-tagging level-order traversal sequence is shown as followed:

A : ltag: 0 , rtag 1
B : ltag: 0 , rtag 0
C : ltag: 0 , rtag 1
D : ltag: 1 , rtag 0
G : ltag: 0 , rtag 1
E : ltag: 0 , rtag 1
H : ltag: 1 , rtag 1
F : ltag: 1 , rtag 0
I : ltag: 1 , rtag 1

则其带度数的后根遍历序列为：
Then, its post-order traversal sequence with degree is:

D0 H0 G1 B2 F0 I0 E2 C1 A2
(注：各个节点按照“节点名度数”的方式给出，节点之间用空格分隔)
现给出树的双标记层次遍历序列如下，则其带度数的后根遍历序列为？
(P.S. The form of each node should be "NameDegree", and all the nodes are separated by only one space.)

Now, given a double-tagging level-order traversal sequence of a tree, shown as followed, please write down its post-order traversal sequence with degree.

A : ltag: 0 , rtag 1
B : ltag: 0 , rtag 0
G : ltag: 1 , rtag 1
C : ltag: 0 , rtag 0
F : ltag: 0 , rtag 1
D : ltag: 1 , rtag 0
E : ltag: 1 , rtag 1
H : ltag: 1 , rtag 0
I : ltag: 1 , rtag 1

(填空2 分)

文字精确：D0 E0 C2 H0 I0 F2 B2 G0 A2

18 对于以下等价类，采用“加权合并规则”（也称“重量权衡合并规则”），进行并查运算，给出最后父节点索引序列。

For the following equivalence class, please use "weighted union rule" and UNION/FIND algorithm to write down the final parent node index sequence.

4-0 6-2 8-4 9-4 3-5 9-5 5-2 1-2 7-1

注意：当合并大小相同的两棵树的时候，将第二棵树的根指向第一棵树的根；根节点的索引是它本身；数字之间用空格隔开。

Notice: When we join two trees with the same size, we let the root of the second tree point to the root of the first tree. The index of the root node is itself. Separate the numbers with only one spaces.

(填空2 分)

文字精确：4 4 6 4 4 3 4 4 4 4

19 对于以下等价类，采用“加权合并规则”（也称“重量权衡合并规则”），进行并查运算，给出最后父节点索引序列。

For the following equivalence class, please use "weighted union rule" and UNION/FIND algorithm to write down the final parent node index sequence.

8-9 3-2 7-4 5-9 6-1 8-6 7-3 2-5 8-0

注意：当合并大小相同的两棵树的时候，将第二棵树的根指向第一棵树的根；根节点的索引是它本身；数字之间用空格隔开。

Notice: When we join two trees with the same size, we let the root of the second tree point to the root of the first tree. The index of the root node is itself. Separate the numbers with only one spaces.

(填空2 分)

文字精确：8 6 3 7 7 8 8 8 8 8